DESY EDMS: INFORMATION MANAGEMENT FOR WORLD-WIDE COLLABORATIONS

J. Bürger, J. A. Dammann, S. Eucker, L. Hagge*, A. Herz, J. Kreutzkamp, S. Pantó, S. Sühl, D. Szepielak, P. Tumidajewicz, N. Welle, DESY, Hamburg, Germany

Abstract

The DESY Engineering Data Management System, DESY EDMS, is a fully Web-based central information management platform at the European XFEL and the Global Design Effort for the International Linear Collider (ILC GDE). It provides functionality for managing documents and 3D CAD data and for performing configuration and change management. It can control complex information structures and keep track of their dependencies and history, i.e. their evolution over time. Due to its powerful capabilities for automating workflows and controlling information access, the DESY EDMS can coordinate processes and manage authorizations and responsibilities in large and complex organizations, which may include several institutes and industrial partners. Applications of the DESY EDMS range from small-scale document management for work groups, up to managing the complexity of world-wide collaborations during design and construction activities. The poster describes the architecture of the DESY EDMS, introduces some of its use cases and reports lessons learned in developing and operating the system.

INTRODUCTION

Engineering Data Management (EDM) is a concept for information management and process automation in product design and development activities. The main objective of EDM is to manage the complexity in large projects. An Engineering Data Management System (EDMS) is an information system which serves as the central collaboration platform, knowledge base and project repository. It includes functionality for document & 3D CAD data management, version control, change & configuration management, and workflow automation.

In industry, EDM is nowadays called Product Lifecycle Management (PLM), expanding the data-centric view to include processes and people, and putting emphasis on covering the whole lifecycle. Managing the product lifecycle has become one of the critical success factors, and PLM systems are equally used in e.g. mass production of consumer goods, automotive and aerospace industries, plant construction and ship building.

EDMS IN ACCELERATOR PROJECTS

Several aspects of accelerator projects are comparable with industrial environments, such as manufacturing large and complex unique products as in plant construction or shipbuilding, working with collaboration partners and companies as suppliers, and creating dedicated organizations with specific roles, responsibilities, policies. An EDMS can transfer experience in these areas from industry to scientific projects by providing mature solutions for e.g.

- Managing large numbers of documents, including handling revisions, traceability and access policies
- Conducting configuration and change management, including handling baselines and alternatives
- Tracking components during manufacturing, installation, operation and maintenance processes
- Protecting confidential information and intellectual property

On the other hand, scientific collaborations differ from industry in many cultural and organizational aspects, which have to be catered for in an EDMS implementation. For example, an EDMS has to be adapted to:

- Acceptance: Scientific collaborations are usually less formal and hierarchical than industry. Decisions are based on acceptance and made taken by consensus, thus tools have to rapidly deliver use and benefits
- Integration: Collaboration partners have their design tool environments and best practices in place, to

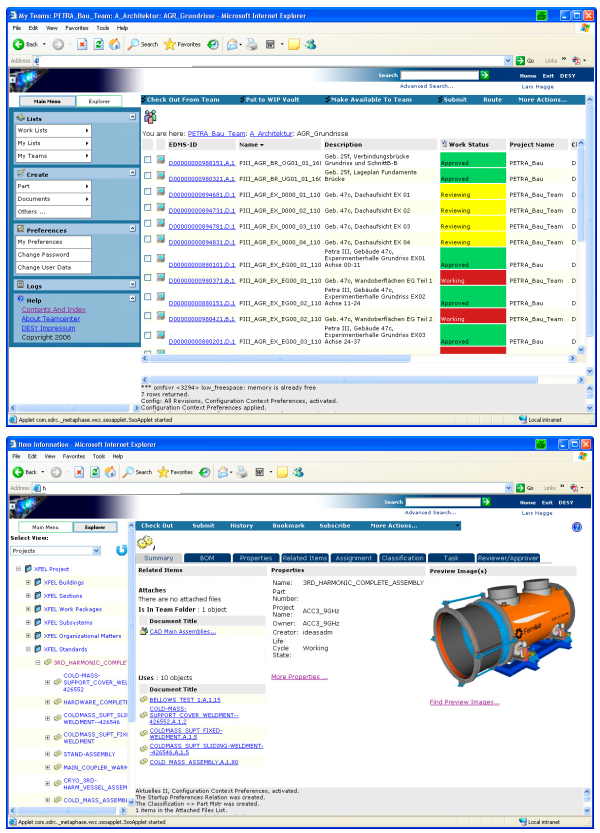

Figure 1: Example Screenshots of the DESY EDMS showing working, reviewing and released documents (top) and an engineering model of an accelerator module (bottom)

*communicating author: lars.hagge@desy.de

maintain their value the EDMS has to easily integrate with their tools

- Flexibility: Developing unique products implies processes and organization develop on demand as the project progresses. The EDMS has to be able to implement new process requirements in short times.
- Casual users: Most users work with the EDMS only on demand, often spontaneously and without prior training. The EDMS has to be compliant with their expectations, i.e. be intuitive to use and provide self-explaining guidance

Figure 1 illustrates the look & feel of the DESY EDMS.

EXAMPLES FOR EDMS APPLICATION

The following selected examples demonstrate some EDMS capabilities and highlight some of the benefits of using an EDMS. They also illustrate the typical process of introducing EDMS to a new application field.

Review and Approval of Planning Documents

A review and approval process has been implemented for the construction of the new PETRA III experimental hall at DESY. The construction company was creating detailed drawings of the new hall and required DESY to review and approve these drawings within 10 working days. As several experts from different technical groups had to check each drawing, an electronic procedure was needed to enable parallel work and ensure the deadlines were met. The EDMS received the drawings from the construction company, routed the drawings to the relevant reviewers, and collected the electronic signatures. The process involved more than 30 reviewers, who processed 2500 drawing versions within ca. one year

An initial process analysis clarified the work flow, roles and responsibilities, and fundamental issues such as the impact of electronic signatures, and information property and access policies. After that, the process workflow was straight forward to implement in the EDMS.

The major benefit from using the EDMS was the capability of three and more reviewers working in parallel on the same drawing and seeing each others comments, which was essential for meeting the tight deadlines (Figure 3). Other benefits include history tracking and traceability of drawings in case of conflicts, a paperless process ensuring fast distribution of information, and a central and complete electronic drawing archive.

The review and approval process is of general nature and has since been adopted by many other applications, such as for example civil construction of the European XFEL, various technical project reviews, and the preparation of CAD documents for tendering.

3D CAD Collaboration

Accelerator components and sub-systems are usually designed and developed by collaborations of several institutes. The EDMS integrates 3D design models from the different groups, even if they are produced with different CAD systems, and makes them available to the entire collaboration through web-based viewing. Again, the workflow was defined in an initial process analysis, along with fundamental design standards such as e.g. common coordinate systems, which are a mandatory pre-condition for being able to integrate the models [2].

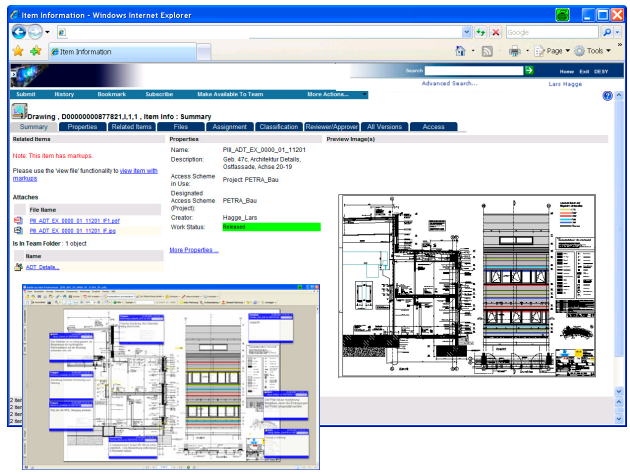

Figure 3: Construction drawing catalogued in EDMS and opened in viewer, enabling multiple reviewers to work in parallel and place mark-ups on the drawing.

Using EDMS, for the first time different groups can check their designs for compatibility in early stages of the design without needing prior agreement on CAD systems and complex data exchange. Both scientists and engineers can participate in the process as the models are accessed and reviewed in the web-based 3D viewer of the EDMS. Figure 2 illustrates 3D CAD collaboration and shows a model with mark-ups in the EDMS web viewer.

Component Tracking and Process Control

S.c. cavities are manufactured by external companies (suppliers) and then quality checked, further processed

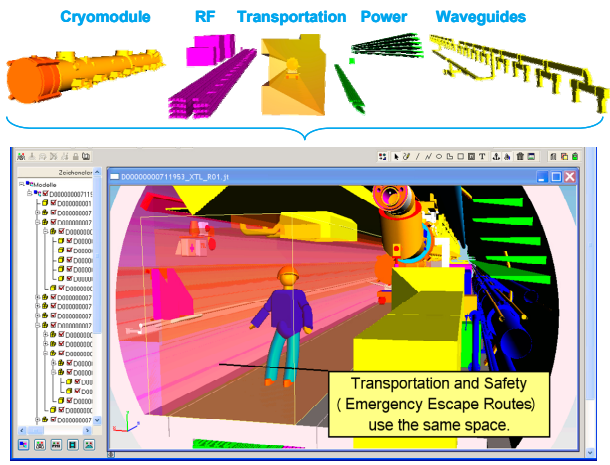

Figure 2: Example for 3D CAD collaboration at XFEL: Work packages are contributing models of their sub-systems in different 3D CAD systems (top), which are then integrated and published in EDMS. The EDMS viewer enables non-CAD-users to access and add reviews to the models (bottom).

and finished at DESY. The EDMS keeps track of the manufactured cavities and coordinates and documents the quality checks of the cavities and their components. Subsequent processing is coordinated through the EDMS by issuing so-called "work packages", which instruct the next processing steps to the responsible teams and keep track of work progress and results.

An initial process analysis defined the processing steps and the data to be collected at each step [3].

The EDMS enables process control in a complex and changing environment. Multiple cavities can be processed at different steps by different teams in parallel. The process coordinator can get status information, inspect intermediate results and decide on the sequencing of process steps. As the process is under continuous improvement, a flexible and dynamic mechanism for process control was implemented, which allows implementing new process requirements by "only" adding new work instructions to the EDMS. The process can be transferred step-wise to collaboration partners and industry, as they can access the EDMS and receive selected work instructions through the web.

EDMS ARCHITECTURE

The DESY EDMS is based on a commercial product and tailored to specific project requirements. It is a fully web-based system, and any collaboration partner can use the same functionality through their web browser.

The EDMS has specific connectors to 3D CAD systems, which enable designers to store their CAD data directly in the EDMS. Other users can view the CAD models using a web-based 3D viewer which is part of the EDMS installation. Figure 4 illustrates the DESY EDMS architectures.

A set of Web services has been developed to integrate the EDMS into existing environments. The web services follow the REST architectural style, allowing creating, updating, retrieving and deleting EDMS objects though simple http calls [4].

The web-services are used in a variety of applications. For example, a manufacturer of s.c. cavities has connected their production planning system (PPS) to directly upload quality inspection data into the EDMS. Further applications include transferring data and content between EMDS and other project databases, and linking EDMS content from project web pages

SUMMARY AND EXPERIENCE

The EDMS offers extensive functionality for light-weight document management and ad-hoc collaboration, which is beneficial and well-accepted in distributed environments and usually the first application for new users. The real power of the EDMS unveils when it is

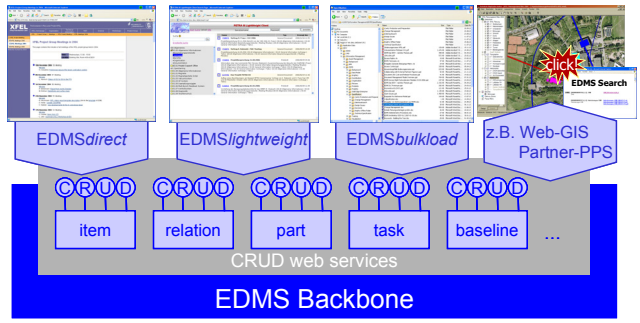

Figure 4: Overview of the DESY EDMS Architecture.

driving critical processes, such as e.g. reviews with deadlines, the complex and distributed 3D CAD collaboration, or fabrication and inspection processes.

For users, the EDMS is easier to adopt and achieves better acceptance when it is used in conjunction with defined processes. Then again, once adopted, the EDMS helps users in further structuring ad-hoc processes and collaboration efforts

As each EDMS application is slightly different, it has turned out that the EDMS is best adopted when users and EDMS support team hold a common initial kick-off workshop for clarifying the intended use (e.g. processes, information types). The EDMS support team can then recommend best practices. Also, as the underlying EDMS implementation is of general nature, the functionality can be extended and adapted to specific needs, if necessary.

Most EDMS applications can start off without any additional customization needs, and when special requests arose, they could be rapidly accommodated so far.

REFERENCES

[1] J. Bürger, J. A. Dammann, L. Hagge, A. Herz, J. Kreutzkamp, S. Pantó, D. Szepielak, P. Tumidajewicz, N. Welle, "Managing the Complexity in Large Scientific Collaborations with PLM Systems", PLM'08, Seoul, July 2008

[2] N. Bergel, L. Hagge, A. Herz, J. Kreutzkamp, S. Sühl, N. Welle, "3D CAD Collaboration at European XFEL and ILC", PAC'09, Vancouver, May 2009 (these proceedings)

[3] J. Bürger, J. A. Dammann, L. Hagge, J. Iversen, A. Matheisen, W. Singer , "Towards Industrialization: Supporting the Manufacturing Processes of Superconducting Cavities at DESY", Phys C, 441(2006)268-271

[4] D. Szepielak, "REST-based Service Oriented Architecture for Dynamically Integrated Information Systems", PhD Symposium at ICSOC'06, Chicago, January 2006